



IEP NEWSLETTER

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Table 2 Annual adult *Eriocheir sinensis* CPUE and estimated total salvage, 1996-2005. Bay Study CPUE is from October (year)-March (year+1), Suisun Marsh CPUE is from July-December, and CVP and SWP salvage is from September-November

Year	Bay Study CPUE	Suisun Marsh CPUE	CVP salvage	SWP salvage
	(#/tow)	(#/tow)	est. total	est. total
1996	0.02	0.00	50	
1997	0.34	0.07	20,000	
1998	2.51	0.89	750,000	
1999	0.96	1.08	90,000	34,000
2000	0.93	0.02	2,500	4,700
2001	3.25	0.17	27,500	7,300
2002	1.07	0.04	2,400	1,200
2003	0.15	0.00	650	90
2004	0.12	0.00	750	370
2005	0.01	0.00	0	18

Fish Salvage at the State Water Project and Central Valley Project Fish Facilities.

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Introduction

The Tracy Fish Collection Facility (TFCF, Federal Facility) and the Skinner Delta Fish Protective Facility (SDFPF, State Facility) divert (salvage) fish from water exported from the San Francisco Estuary. The TFCF began operation in 1957 and the SDFPF began operation in 1968. Both the TFCF and the SDFPF use a louver-bypass system to salvage fish from the exported water. The salvaged fish are returned to the San Francisco Estuary by loading the salvaged fish into tanker trucks and trucking them to predetermined release sites.

Exports

The State Water Project (SWP) exported roughly 4.9 billion m³ (4,028,860 acre-feet); a record high for all years of record since 1981. The next highest annual exports

occurred in 1989 (4.67 billion m³) and 2000 (4.61 billion m³). Monthly exports ranged from a high of 590 million m³ (478,574 af) in January to a low of 150 million m³ (121,442 af) in May (Figure 1). Exports from June through December were more stable and ranged from 403 – 539 million m³ (326,840 – 436,628 af) (Figure 1).

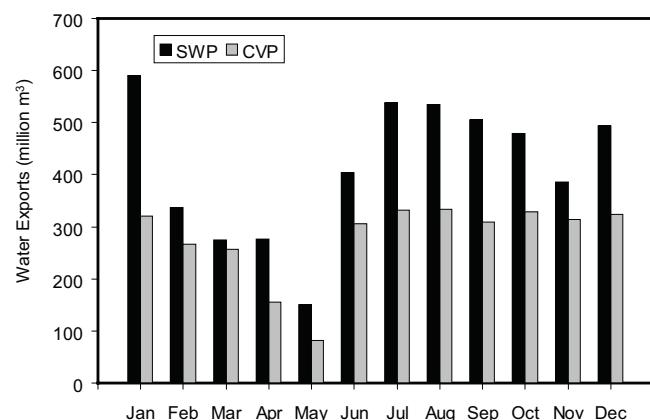


Figure 1 Monthly water exports for the SWP and CVP, 2005

The Central Valley Project (CVP) exported 3.33 billion m³ (2,697,077 af) of water in 2005, almost the identical amount exported in 2004 (3.32 billion m³). Monthly exports followed the same trend as the SWP. Exports decreased from a high of 320 million m³ (259,248 af) in January to a low of 81 million m³ (65,857 af) in May (Fig-

ure 1). Monthly exports from June through December were stable, ranging from 306 – 334 million m³ (247,959 – 271,049 af) (Figure 1).

Fish Salvage

Threadfin shad was a large component of annual salvage of fish at both facilities. The SWP salvaged roughly 3.02 million fish while the CVP salvaged roughly 2.43 million fish. Density (individuals salvaged per 10,000 m³) was highest at SWP in July and at CVP in November (Figure 2). Threadfin shad were the predominate species at CVP, making up 46% of the annual salvage (Figure 3). Threadfin shad were the second most predominant species at SWP, making up 39% of annual salvage while American shad made up 41% (Figure 4). The percentage of annual salvage of threadfin shad decreased from 2004 for both facilities (Figure 5).

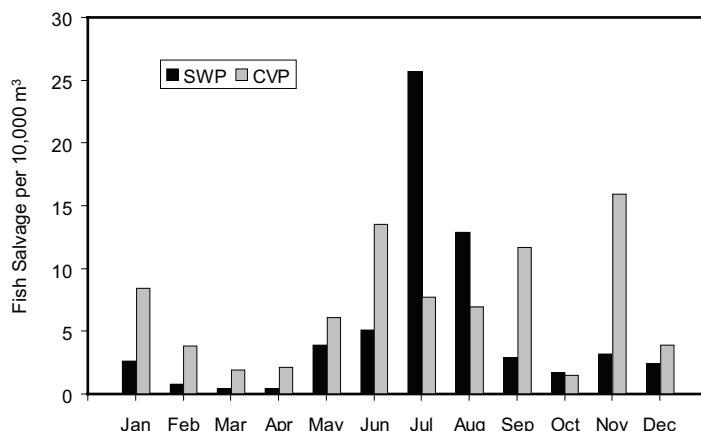


Figure 2 Fish salvage density at the SWP and SVP, 2005

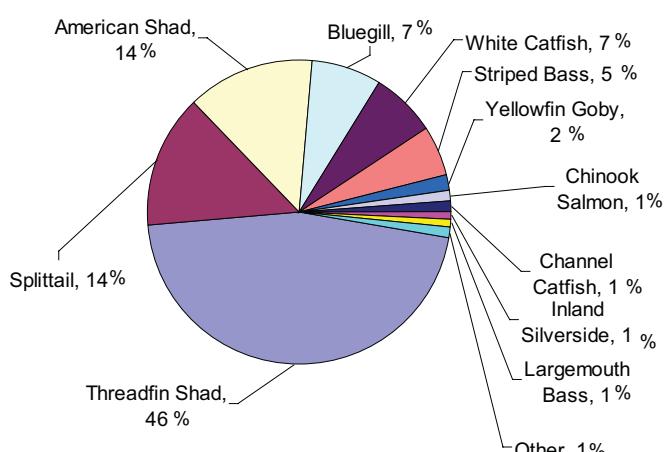


Figure 3 Relative species composition at the CVP, 2005

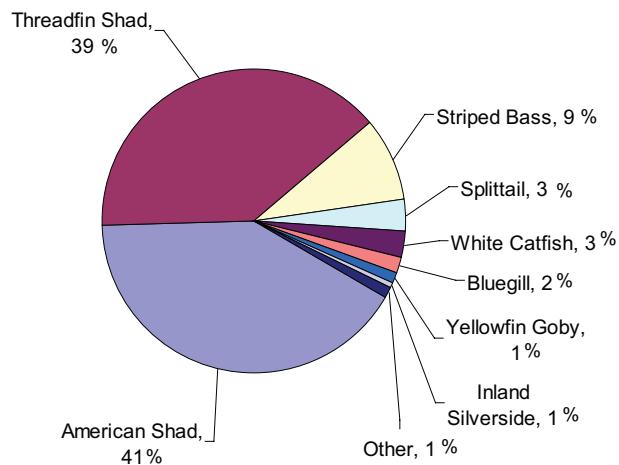


Figure 4 Relative species composition at the SWP, 2005

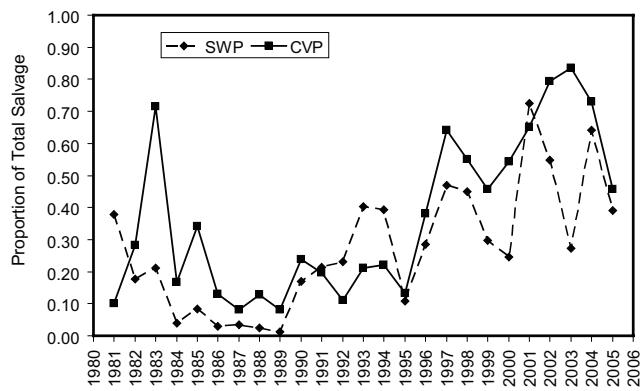


Figure 5 Relative proportion of threadfin shad in salvage at the SWP and CVP, 1981-2005

Delta smelt

The salvage of delta smelt at both facilities was very low in 2005, but not record lows. The salvage of delta smelt at SWP was 2,922 and at CVP it was 830. The low of record (since 1981) was 276 for SWP in 1998 and 180 for CVP in 1995. However, salvage at both facilities has been in constant decline since 2002, when it had increased from 2001 (Figure 6). Salvage of delta smelt in 2005 occurred in 2 discrete pulses for both facilities. Salvage occurred mainly in January–February (adults, previous year class) and May–June (juveniles, current year class) (Figure 7).

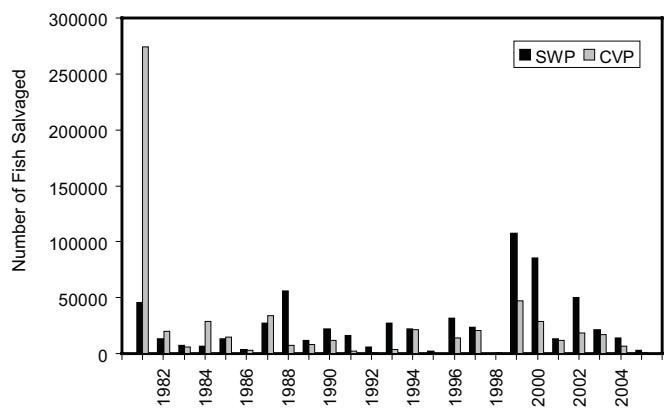


Figure 6 Annual salvage of delta smelt at the SWP and CVP, 1981-2005

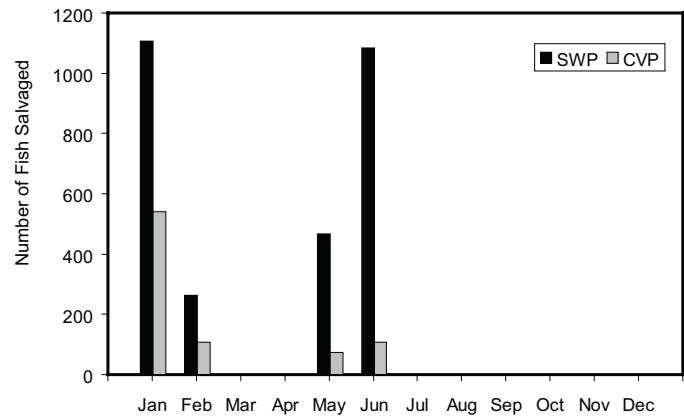


Figure 7 Monthly salvage of delta smelt at the SWP and CVP, 2005

Chinook Salmon

Low numbers of Chinook salmon were salvaged at both facilities, a continuation of a trend since 2002 (Figure 8). The annual salvage of wild and hatchery salmon (combined salvage) was 13,065 at SWP and 25,637 at CVP. The combined salvage of salmon consisted primarily of wild (unclipped) fish: 78% wild and 22% hatchery (adipose clipped). Combined salvage of wild salmon consisted primarily of fall and spring run sized fish (determined by fork length, Figure 9, Table 1). The CVP salvaged roughly twice the wild salmon, 19,963, as the SWP, 10,345 (Table 1). The monthly salvage of wild salmon was highest from March through June for the CVP and April through June for the SWP (Figure 10).

Loss, an estimate of mortality resulting from entrainment at the facilities, was higher for wild fish and at the SWP. Loss was almost 4 times greater for wild as opposed to hatchery fish (both facilities combined): wild - 60,856, hatchery – 16,408. Loss was 3 times greater at the SWP, 46,192, than the CVP, 14,664 (wild fish, Table 1).

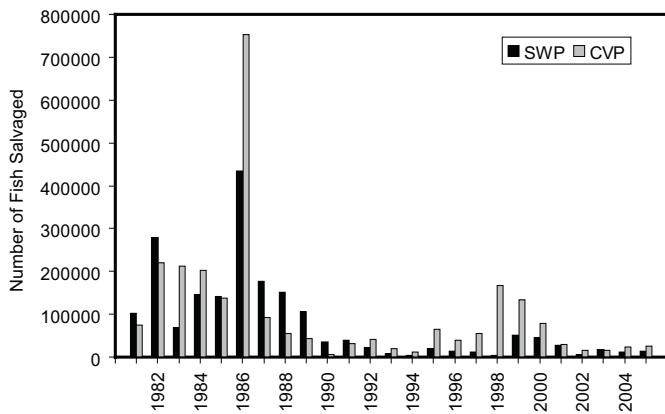


Figure 8 Annual salvage of wild and hatchery Chinook salmon (combined) at the SWP and CVP, 1981-2005

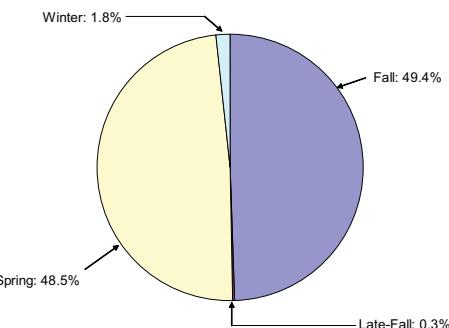


Figure 9 Relative contribution of wild Chinook salmon by race at the SWP and CVP (combined), 2005

Table 1 Wild Chinook salmon salvage and loss, 2005

Race	SWP - Annual Salvage	CVP Annual Salvage	Total Salvage	SWP - Annual Loss	CVP - Annual Loss	Total Annual Loss
Fall	5,571	9,409	14,980	25,170	6,718	31,888
Late-fall	15	84	99	66	54	120
Spring	4,443	10,245	14,688	19,552	7,742	27,294
Winter	316	225	541	1,404	150	1,554
Total	10,345	19,963	30,308	46,192	14,664	60,856

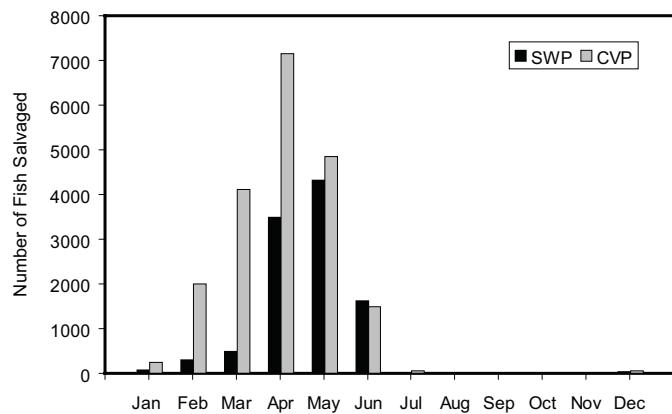


Figure 10 Monthly salvage of wild Chinook salmon at the SWP and CVP, 2005

Steelhead

The salvage of steelhead was low for both facilities in 2005 and continued a decline in salvage that started in 2003 (Figure 11). The salvage of hatchery steelhead was almost twice that of wild steelhead: 2,207 hatchery as opposed to 1,297 wild. The SWP salvaged 1,414 hatchery origin, 779 wild and 3 of unknown origin for a total of 2,196 salvaged. The CVP salvaged 793 hatchery origin, 518 wild, and 36 of unknown origin for a total salvage of 1,347 steelhead. The pattern of monthly salvage of steelhead was the same for both facilities with monthly salvage peaking in March for the CVP and April for the SWP (Figure 12).

Striped Bass

The annual salvage of striped bass at both facilities in 2005 was very low. The SWP salvaged 269,825. The CVP salvaged 124,537, a new low for the period since 1981. The low values of salvage at both facilities in 2005 are a continuation of low values since 2001 (Figure 13). The monthly salvage of striped bass at both facilities predominately occurred in 2 pulses: January – March and June – December (Figure 14). Salvage at the SWP was driven by salvage in July, which accounted for 51% of the annual salvage (Figure 14).

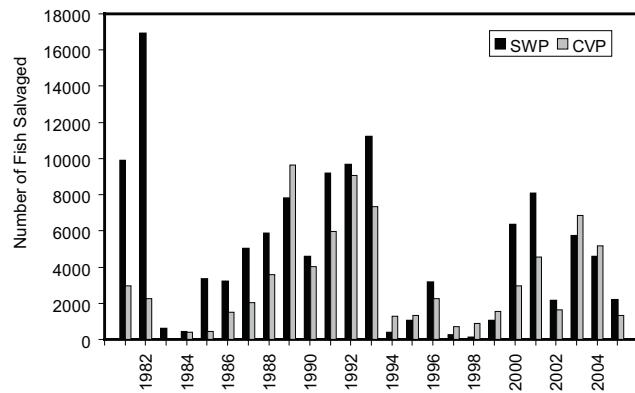


Figure 11 Annual salvage of wild and hatchery steelhead (combined) at the SWP and CVP, 1981-2005

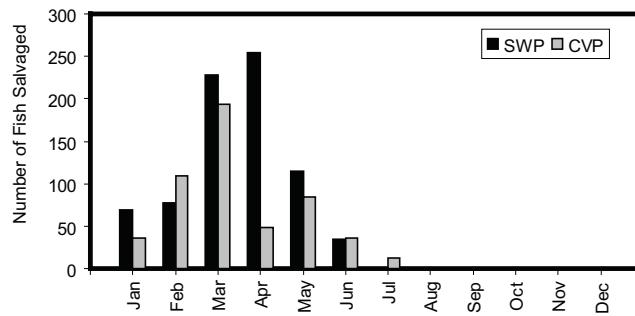


Figure 12 Monthly salvage of wild steelhead at the SWP and CVP, 2005

American Shad

The trend of annual American shad salvage was different depending upon facility. Salvage of American shad at SWP in 2005 was 5 times that in 2004: 1,228,387 as opposed to 242,780. However, large inter-annual variation in salvage at SWP was not unique to 2004-2005, especially after 1993 (Figure 15). The salvage of American shad at the CVP was 329,047 and continued a decline that began after 2003 (Figure 15). The bulk of salvage at SWP occurred during July and August while at CVP the bulk of salvage was from October – December (Figure 16).

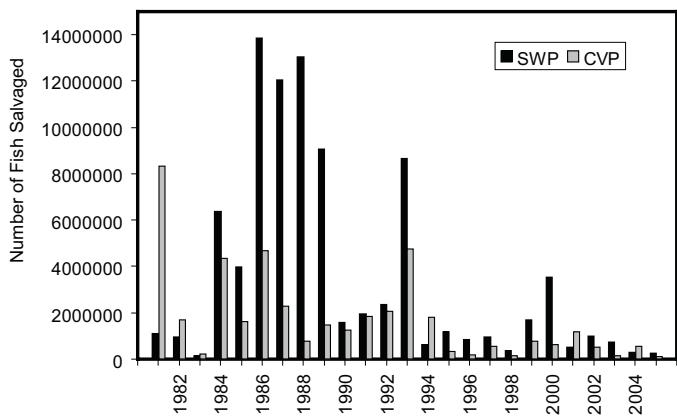


Figure 13 Annual salvage of striped bass at the SWP and CVP, 1981-2005

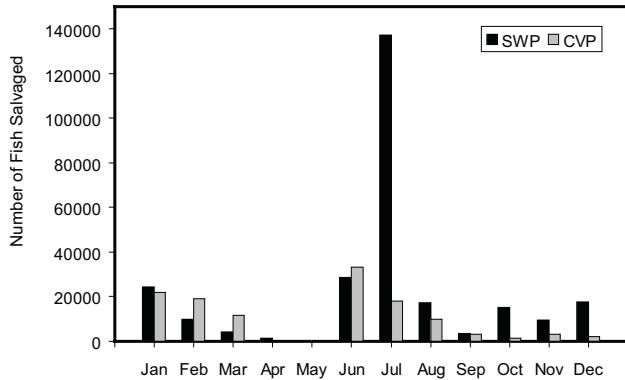


Figure 14 Monthly salvage of striped bass at the SWP and CVP, 2005

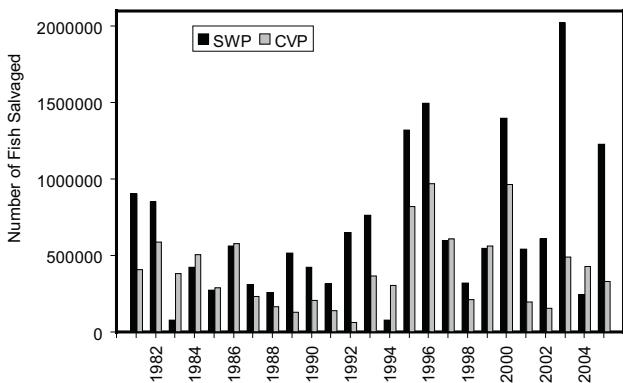


Figure 15 Annual salvage of American shad at the SWP and CVP, 1981-2005

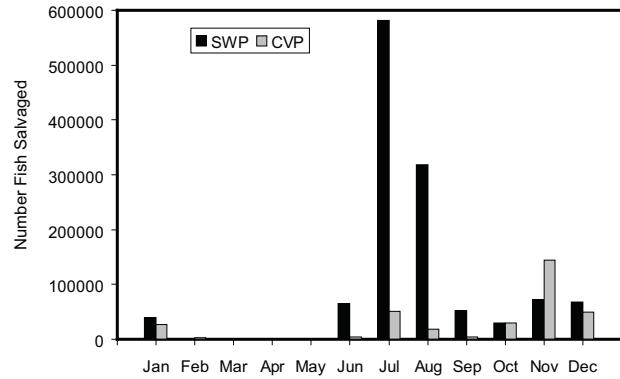


Figure 16 Monthly salvage of American shad at the SWP and CVP, 2005

Splittail

The salvage of splittail at both facilities was high in 2005, but not near record high values. The SWP salvaged 102,308 splittail in 2005; annual salvage totals over 67,000 were uncommon (Figure 17). The CVP salvaged 342,655 splittail in 2005; the facility rarely salvaged more than 135,000 splittail annually (Figure 17). However, the salvages in 2005 are dwarfed by all time record salvages in 1986, 1995, and 1998 (Figure 17).

The splittail salvage was confined to a narrow time frame, May – July (Figure 18), and was comprised primarily of age-0 fish. Length ranges were: SWP, 21 – 431 mm FL and CVP, 20 – 395 mm FL. However, 95th percentiles occurred at 81 mm FL for the SWP and 82 mm FL for the CVP.

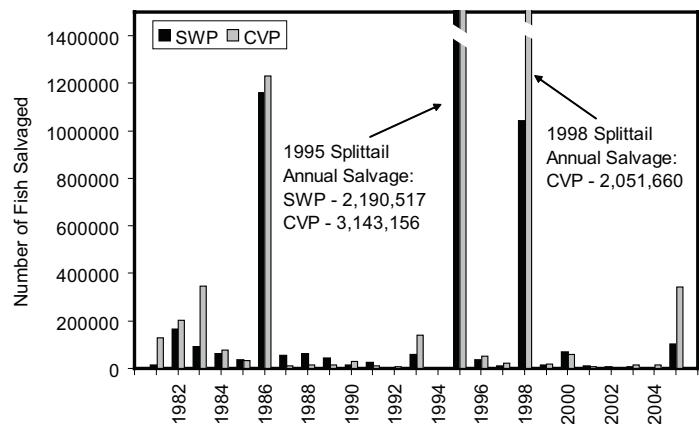


Figure 17 Annual salvage of Sacramento splittail at the SWP and CVP, 1981-2005. Columns for 1995 and 1998 have been truncated for scale considerations.

Longfin Smelt

The salvage of longfin smelt in 2005 was low: the SWP salvaged 183 and the CVP salvaged 36. Low salvage has been typical at both facilities since 1981 except in low outflow years 1984-85, 1987-1990 and 2002 (Figure 19).

Chinese Mitten Crabs

Mitten crab salvage was the lowest recorded for both facilities since 1999. The salvage for CVP was:

- 1999 – 25,104
- 2000 – 2,124
- 2001 – 18,144
- 2002 – 1,383
- 2003 – 804
- 2004 – 745
- 2005 – 48

The salvage for SWP was:

- 1999 – 33,902.5
- 2000 – 5,110.3
- 2001 – 7,452
- 2002 – 1,271
- 2003 – 160
- 2004 – 366
- 2005 – 39

Chinese mitten crabs have been less than 1% of the annual salvage for each facility in any given year since 1999.

In 2005, mitten crabs were salvaged on 4 days at the SWP and 5 days at CVP. The CVP salvaged a total of 48 mitten crabs on January 6, 19, 21 and 31. The SWP salvaged a total 39 mitten crabs on January 2 and 21, April 8, September 18 and October 15.

Temperature

The mean daily water temperature displayed the same basic pattern for both facilities, with the range of temperatures being larger for SWP. Mean daily temperature generally increased and peaked in July and then decreased until December (Figure 20). Mean daily temperature at the CVP ranged from 8.0^0 – 26.4^0 C while mean daily temperature at the SWP ranged from 1.7^0 – 27.6^0 C. However, the low temperatures observed at SWP in the first part of the year (January – May), are abnormally low. A possible explanation is a malfunction in the temperature sensor that was corrected later in the year. This is suggested by the close tracking of SWP and CVP mean daily temperatures sometime after the middle of June (Figure 20).

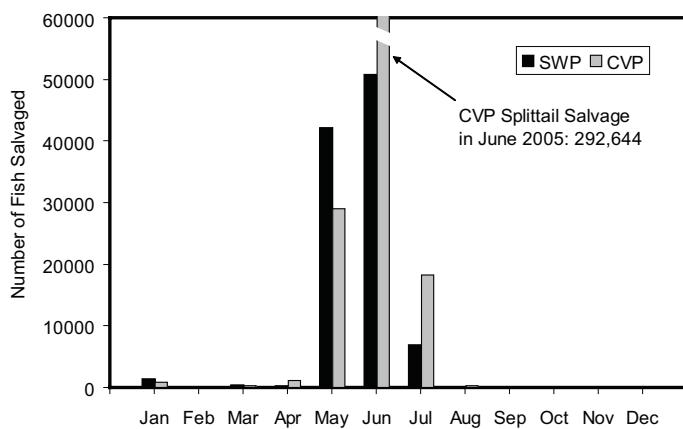


Figure 18 Monthly salvage of splittail at the SWP and CVP, 2005. The column for CVP, June, has been truncated for scale considerations.

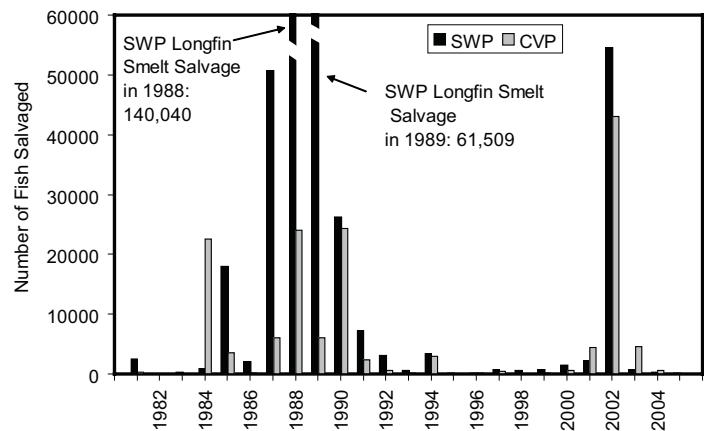


Figure 19 Annual salvage of longfin smelt at the SWP and CVP, 1981-2005. Columns for SWP 1988 and SWP 1989 have been truncated for scale considerations.

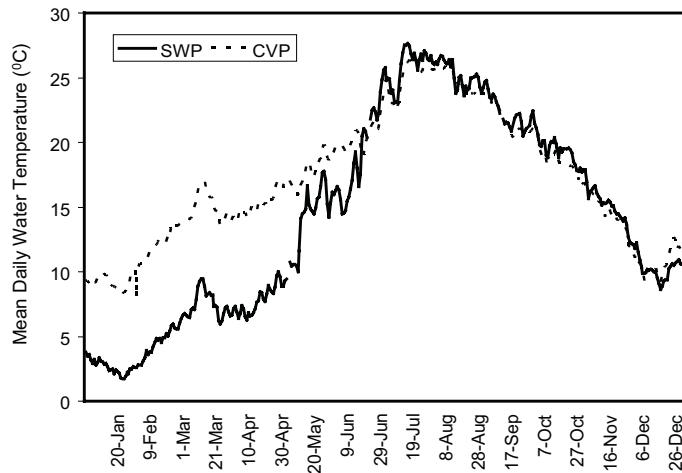


Figure 20 Mean daily water temperatures at the SWP and CVP, 2005

Estimating Relative Abundance and Survival of Juvenile Chinook Salmon in the Sacramento - San Joaquin Estuary

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Introduction

Relative juvenile Chinook salmon (*Oncorhynchus tshawytscha*) abundance and survival has been estimated in the Sacramento-San Joaquin Estuary for several years to evaluate population trends over time. Abundance and survival estimates prior to 1997 were summarized and discussed in a previous document (Brandes and McLain, 2001). The purpose of this article as well as one presented previously (IEP Newsletter, 2003) is to update trend analyses with recent abundance and survival estimates and to determine if trends observed in previous data have continued.

Previous analyses indicated that the abundance of juvenile salmon in the beach seine, between January and March in the North Delta and Bay areas, was positively

related to Sacramento River flow at Freeport in February ($r^2=0.69$, $p<0.01$ and $r^2=0.98$, $p<0.01$, respectively)(Brandes and McLain, 2001). It was also shown that catch in the Sacramento trawl between April and June was inversely related to flow at Freeport in February ($r^2 = 0.88$, $p<0.01$)(Brandes and McLain, 2001). We have hypothesized that in years with high winter flows (February used as a surrogate month), less juvenile Chinook stay upstream to migrate into the Delta later as smolts (Brandes and McLain, 2001). Furthermore, abundance at Chippis Island between April and June was correlated to flows at Rio Vista between April and June ($r^2=0.78$, $p<0.01$)(Brandes and McLain, 2001), indicating that overall the number of juvenile Chinook salmon leaving the Delta increases as flows increase.

Previous analyses on juvenile salmon survival in the Delta and upstream indicates that survival for groups released near Red Bluff Diversion Dam survive at a higher rate in wet years than those released in the Delta near Clarksburg (Brandes and McLain, 2001). In addition, fry released in the north Delta (Isleton) appeared to survive better than those released in the interior Delta (mouth, North or South Fork of the Mokelumne River) in the drier years (Brandes and McLain, 2001).

Methods

Relative juvenile salmon abundance

The USFWS Stockton office has employed two sampling methods to monitor the relative abundance of juvenile Chinook salmon in the Sacramento-San Joaquin Rivers and Estuary: beach seining, and midwater trawling. Beach seining occurs in six geographical regions and includes the lower Sacramento River between Elkhorn and Colusa (Region 1), the north Delta (Region 2), the central Delta (Region 3), the south Delta (Region 4), the San Joaquin River from Mossdale upstream to the mouth of the Tuolumne River (Region 5), and the San Francisco and San Pablo Bays (Region 6)(Figure 1). Midwater trawling has been conducted on the Sacramento River just downstream from Sacramento (in 1990 sampling was further downstream near Courtland) and at Chippis Island below the confluence of the Sacramento and San Joaquin Rivers (Figure 1).

Each gear targets different life-stages of juvenile Chinook salmon. The beach seine is considered more efficient for smaller juvenile salmon (fry) rearing near the